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For: PROTON CONDUCTING POLYMER MEMBRANE COMPRISING  
PHOSPHONIC ACID GROUPS CONTAINING POLYAZOLES  
AND THE USE THEREOF IN FUEL CELLS

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TRANSMITTAL OF INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

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Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

Enclosed for filing in the U.S. Receiving Office is a copy of the English translation of the International Preliminary Examination Report (11 pages).

Please charge any deficiency or credit any overpayment in the fees that may be due in this matter to Deposit Account No. 08-0380. A copy of this letter is enclosed for accounting purposes.

Respectfully submitted,

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**Translation**

PATENT COOPERATION TREATY

PCT/EP2003/010906



**PCT**

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2002/CVG035	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP2003/010906	International filing date (day/month/year) 02 October 2003 (02.10.2003)	Priority date (day/month/year) 04 October 2002 (04.10.2002)
International Patent Classification (IPC) or national classification and IPC B01D 71/62		
Applicant PEMEAS GmbH		

<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of <u>8</u> sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of <u>          </u> sheets.</p>	
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the report</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input checked="" type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input checked="" type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input checked="" type="checkbox"/> Certain observations on the international application</p>	

Date of submission of the demand 04 May 2004 (04.05.2004)	Date of completion of this report 07 April 2005 (07.04.2005)
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/EP2003/010906

## I. Basis of the report

### 1. With regard to the elements of the international application:\*

- ☐ the international application as originally filed
- ☒ the description:  
 pages \_\_\_\_\_ 1-37 \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☒ the claims:  
 pages \_\_\_\_\_ 1-28 \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, as amended (together with any statement under Article 19  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the drawings:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
 pages \_\_\_\_\_, as originally filed  
 pages \_\_\_\_\_, filed with the demand  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

### 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item. These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

### 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

### 4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/fig \_\_\_\_\_

### 5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

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## III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application.

☒ claims Nos. 1-5. 8. 10-28(part)

because:

☐ the said international application, or the said claims Nos. \_\_\_\_\_  
relate to the following subject matter which does not require an international preliminary examination (*specify*):

☐ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. \_\_\_\_\_  
are so unclear that no meaningful opinion could be formed (*specify*):

☐ the claims, or said claims Nos. 9 (whole). 1-5. 8. 10-28 (part) are so inadequately supported  
by the description that no meaningful opinion could be formed.

☒ no international search report has been established for said claims Nos. \_\_\_\_\_

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the standard.

☐ the computer readable form has not been furnished or does not comply with the standard.

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IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:

- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

- ☐ complied with.
- ☐ not complied with for the following reasons:

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

- ☐ all parts.
- ☒ the parts relating to claims Nos. 1-5.8, 10-28(part), 6.7 (whole)

**INTERNATIONAL PRELIMINARY EXAMINATION REPORT**

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**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

SEE SUPPLEMENTAL SHEET

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

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## Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: III.1

Non-establishment of opinion with regard to  
novelty, inventive step and industrial  
applicability

The subject matter of the second group of  
inventions (claim 9) has not been searched (see  
Box IV). The subject matter of the claims that  
have not been searched relates to proton-conductive  
layers produced using diamino-carboxylic acids, at  
least some of which comprise phosphonic acid  
groups. Therefore, no substantive examination  
has been carried out for the relevant claims (PCT  
Rule 66.1e). The applicant is advised, however,  
that the only embodiment according to the  
application relates to the first group of  
inventions.

For the claims in which the subject matter of the  
second group of inventions is an optional feature  
(claims 1-5, 8 and 10-28), the substantive  
examination relates to the features of the first  
group of inventions.

## Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: IV.2

**Lack of unity of invention**

The International Examining Authority concurs with the opinion of the ISA that the submitted claims fail to satisfy the requirements of PCT Rule 13.1. According to the present opinion, however, only two inventions can be distinguished since the prior art closest to the subject matter of independent claim 1 also discloses the subject matter of independent claim 24 (see Box V.2, point 1.).

The application consequently fails to meet the requirement of unity of invention (PCT Rule 13.1), since there is no technical relationship among the subjects of the groups of claims involving one or more of the same or corresponding special technical features (PCT Rule 13.2):

1. Claims 6 and 7 and parts of claims 1-5, claim 8 and claims 10-28:

proton-conductive layer produced using tetra-amino compounds and aromatic and/or heteroaromatic carboxylic acids containing at least two acid groups per monomer, at least some of one of the groups of compounds comprising at least one phosphonic acid group.

2. Claim 9 and parts of each of claims 1-5, claim 8 and claims 10-28:

proton-conductive layer produced using diamino-carboxylic acids, at least some of which comprise phosphonic groups.



## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

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## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

## 1. Statement

Novelty (N)	Claims		YES
	Claims	1, 3, 6-8, 19, 20, 22-24, 26-28	NO
Inventive step (IS)	Claims		YES
	Claims	1-8, 10-28	NO
Industrial applicability (IA)	Claims		YES
	Claims	1-8, 10-28	NO

## 2. Citations and explanations

Reference is made to the following documents:

- D1: JP-2002146014-A  
D2: Y. SAKAGUCHI ET AL: POLYMERIC MATERIALS  
SCIENCE AND ENGINEERING, vol. 84, 2001,  
pages 899-900, XP001091393  
D3: US-A-5 599 639 (M. J. SANSONE ET AL)  
4 February 1997 (1997-02-04)  
D4: JP-2003022709-A -  
D5: WO-0238650-A.

## 1. Novelty

- 1.1 D1 discloses (according to the computer translation) a method for the production of proton-conducting polymer membranes for fuel cells and membrane electrodes (§20). In example 1 (§25), a mixture of tetra-amino diphenylsulfone (TAS) and dicarboxyphenyl phosphoric acid (DCP) with terephthalic acid, polyphosphoric acid being added under a nitrogen atmosphere, is heated (to 220°C), applied to a support, the depth of the application being 0.225 mm, and cured at 80°C in the presence of water. The subject matter of claims 1, 3, 6, 8, 19, 20, 22-24 and 26-28 therefore lacks novelty.

1.2 Independently thereof, this method is also disclosed in D2 (table I, example TTP66). The subject matter of claims 1, 3, 6, 8, 19 and 20 therefore lacks novelty.

1.3 Independently thereof, this method is also disclosed in D5 (see example 11). The subject matter of claims 1, 3, 6-8, 19 and 20 therefore lacks novelty.

2. Inventive step

Dependent claims 2, 4, 11-19, 21 and 25 define a series of features relating to details or specify materials. It is not currently possible to identify the problem solved by means of said features or the effect thereby achieved. The requirements of PCT Article 33(3) cannot be considered to be satisfied unless, consequent upon the selection, a membrane and/or electrode has advantageous properties relative to the prior art (D1, D2, D5) (for example increased proton conductivity at the same temperature, greater resistance to heat etc.). This must be shown by appropriate comparative tests.

In consequence, claims 2, 4, 11-19, 21 and 25 fail to satisfy the requirements of PCT Article 33(3).

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VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

i Observation relating to the options encompassed by the drafting of the production features in claim 1:

A) it is presumed that step A) comprises the following options:

- a) mixture of tetra-amino compounds with carboxylic acids (one or both thereof containing phosphonic acid groups) in polyphosphoric acid;
- b) mixture of diamino-carboxylic acids containing phosphonic acid groups in polyphosphoric acid.

The arguments set out in Box V are based on this interpretation.

However, the present wording also allows of the interpretation that the feature "in polyphosphoric acid" refers only to mixture b).

ii Claim 14 defines di-, tri- and/or tetra-carboxylic acids in the mixture. However, it is unclear whether this definition is a further specification of the aromatic and/or heteroaromatic carboxylic acids according to claim 1 or relates to an additional component.

Similar objections apply in respect of the back-references in claims 8-13 and 16.

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

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VIII. Certain observations on the international application

A back-reference to a substance class A according to the present claims should be characterised using the wording "characterised in that substance class A comprises a substance B1, B2 and/or B3" (see claim 2).